PERFORMANCE TUNING
GET BIG BANG FOR YOUR BUCK

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PRESENTATION RULES

Always Ask Questions

Interrupt Me

This is a two-way conversation, let’s learn from each other’s experiences
BEST PRACTICES

Start with the basics
## POWER PLAN

Windows Control Panel Power Options

### Control Panel Home
- Choose what the power button does
- Create a power plan
- Choose when to turn off the display

### Choose or customize a power plan

A power plan is a collection of hardware and system settings (like display brightness, sleep, etc.) that manages how your computer uses power. [Tell me more about power plans](#).

#### Preferred plans

- **Balanced (recommended)**
  - Automatically balances performance with energy consumption on capable hardware.
  - [Change plan settings](#)

- **High performance**
  - Favors performance, but may use more energy.
  - [Change plan settings](#)

### Change settings that are currently unavailable

### See also
- User Accounts

### 70%
SERVICES

Why are you running this?
Build List
https://sqlserverbuilds.blogspot.com/
MEMORY
Proper configuration is vital

- Min and Max Memory
- Multiple Instances
- Extra Services SSRS, SSIS, SSAS
- Lock Pages in Memory *
- Set Memory Reservation for Your VM on Host
- Don’t over allocate!
Everything Uses TEMPDB Make sure you don’t ignore it.

Pin to High Performing Disk
Multiple Files
1 file per CPU core up to 8 files

Trace flag 1118/1117
Pre 2016

Heavy Contention in Metadata fixed
2016 CU 8 and 2017 CU 5

Trace Flag 2453 to allow table variables to trigger recompile
MAKE FRIENDS WITH NETWORK & STORAGE ADMINS

Their baby might be ugly
VIRTUAL ENVIRONMENTS

Over Provisioned Hosts

- Too Many VMs on One Host
- What Happens on One VM Now Effects Another
- VM Over/Under CPU Allocation
- Thin Provisioning
Row/Page Compression - More Data In MEMORY

Saves Space on Disk

Backup Compression: Less Data in STORAGE

Costs CPU speed, but worth it

COMPRESSION
More data in memory – It’s the GOLDEN EGG!
ALLOW SNAPSHOT ISOLATION & READ COMMITTED SNAPSHOT ISOLATION (RCSI)

Ta-dah!

READERS CANT BLOCK WRITERS
AND
WRITERS CANT BLOCK READERS

RCSI option

Allows access to versioned rows under the default READ COMMITTED isolation level.

If set to OFF, you must explicitly set the level for each session in order to access versioned rows
# STATISTICS

This is the magic sauce that helps the optimizer.

<table>
<thead>
<tr>
<th>Maintain</th>
<th>Keep These Up To Date!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Updates</td>
<td>Sync vs Async</td>
</tr>
<tr>
<td>Large Table</td>
<td>Trace Flag 2371</td>
</tr>
<tr>
<td>Missing Stats</td>
<td>Did You Know You Can Make Your Own?</td>
</tr>
</tbody>
</table>

Defaulted in SQL 2016
# PARALLELISM

CAUTION: Using too many cores = more overhead to put things back together

## MAX Degree of Parallelism (MaxDop)

<table>
<thead>
<tr>
<th>&gt;= 8 maxdop 8 or lower</th>
<th>&lt;8 logical processors match number of logical processors or lower</th>
</tr>
</thead>
</table>

- Can specify maxdop for individual statements as query hint
- CAUTION Changes Flushes Procedure Cache

## Cost Threshold for Parallelism (CTfP)

<table>
<thead>
<tr>
<th>“Cost” over this value qualifies for multiple processors to execute</th>
<th>Process Count defined by MaxDop</th>
</tr>
</thead>
</table>

- Good Start is 35-50 *Keeps small queries single threaded
- Watch for CXPACKET Waits too many then adjust CTfP higher *
INSTANT FILE INITIALIZATION (IFI)

- Initialized instantaneously to avoid zeroing operations
- Reclaims used disk space

**FAST EXECUTION On Data Files**

- Add Data/Log Files
- Create Database
- Increase File Size & Autogrowth
- Restore

SQL Server service account Perform Volume Maintenance Tasks security policy in Windows. Use AD Group Policy to grant this to service accounts in your domain.
WINNING RESULTS

Create 5GB DB IFI Comparison

Milliseconds

Without Instant File Initialization  With Instant File Initialization
Trace Flag 610
SQL Server
2008 – 2014

*2016 Defaulted Bulked Logged

- SELECT INTO
- INSERT SELECT
- CREATE INDEX
- MERGE

Data Warehouse or Repeatable Loads

High Volume Data Loads Faster

Log Files Smaller

Logs Extent Allocation & Metadata

No Point in Time Recovery

Simple or Bulked Logged
VIRTUAL LOG FILES

Performance boost on startup, insert/update/delete & backup/restore operations.

- A large number of VLFs can slow things down.
- VLF counts under 100 ideally
- Shrink files to two VLFs
- Grow in chunks back to the current size
- DBCC LOG INFO or sys.dm_db_log_stats (2016 SP2)
INDEXES

These are not set it and forget it

- Remove Un-Used Indexes
- Find Missing Indexes
- Covering Indexes

- Wasted Write Disk IO
  Disable then Delete
- Wasted Read IO
  Avoid Duplicates
- Consolidate Indexes
  Specific Query Tuning – Key Lookups
## EXECUTION PLANS

**Easy things to look at**

<table>
<thead>
<tr>
<th>Index Needs</th>
<th>More Granular Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing Includes</td>
<td></td>
</tr>
<tr>
<td>Scans</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sorts</th>
<th>Does the data need to be sorted?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can it be done elsewhere?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Lookups</th>
<th>Extra Reads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easily Avoided in Most Cases</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spills</th>
<th>Spills to TempDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced to go to Disk</td>
<td></td>
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Accelerate your platform.
Optimize licensing.
Reduce your IT footprint.
Pay off technical debt.
Unburden your environment.